
गेज ग्लास — विशिष्टि
भाग 3 थ्रू-विज़न और प्रतिबिंब ग्लास
(दूसरा पुनरीक्षण)

Gauge Glasses — Specification
Part 3 Through-Vision and Reflex Glasses
(Second Revision)

ICS 17.040.30

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भारतीय मानक ब्यूरो
BUREAU OF INDIAN STANDARDS
मानक भवन, 9 बहादुर शाह ज़फ़र मार्ग, नई दिल्ली - 110002
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI - 110002
www.bis.gov.in www.standardsbis.in

FOREWORD

This Indian Standard (Part 3) (Second Revision) was adopted by the Bureau of Indian Standards after the draft finalized by the Chemical Engineering Plants and Related Equipment Sectional Committee had been approved by the Mechanical Engineering Divisional Council.

This standard was first published in 1969 in two parts and then revised in 1985. The present revision has been taken up with a view to incorporate the modification found necessary as a result of experience gained in the use of this standard. Also, in this revision, the standard has been brought into the latest style and format of Indian Standards, and references to Indian Standards, wherever applicable have been updated. BIS certification marking clause has been modified to align with the revised *Bureau of Indian Standards Act, 2016*.

This standard on gauge glass, Part 3 Through-vision and reflex glasses is one of the series of standards on gauge glasses. Other parts of this standard are:

- Part 1 Tubular glasses for level gauges
- Part 2 Protector glasses for tubular gauge glasses
- Part 4 Circular sight and light glasses
- Part 5 Port gauge glasses as used in fittings for steam boilers

The composition of the Committee responsible for the formulation of this standard is given in Annex B.

For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 2022 'Rules for rounding off numerical values (*second revision*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

GAUGE GLASSES — SPECIFICATION

PART 3 THROUGH-VISION AND REFLEX GLASSES

(*Second Revision*)

1 SCOPE

This standard (Part 3) covers the requirements for the through-vision and reflex glasses.

2 REFERENCES

The standard given below contain provisions which, through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent edition of this standard:

<i>IS No.</i>	<i>Title</i>
IS 5428 (Part 1) : 1985	Specification for gauge glasses: Part 1 Tubular glasses for level gauges (<i>first revision</i>)

3 DEFINITIONS

For the definitions of various terms used in the glass industry, refer to 2 of IS 5428 (Part 1).

4 MATERIAL

4.1 Through-vision and reflex glasses shall be made from toughened borosilicate or toughened soda-lime glass as may be suitable for the purpose for which it is used. They shall be mechanical and thermal shock resistant type.

4.2 Through-vision and reflex glasses shall be free from defects that would interfere with vision or service.

4.3 The following properties shall be decided between purchaser and manufacturer depending on working conditions and shall be specified along with requisitions:

- a) Chemical resistance to water, acid and alkalis with some minimum limits;
- b) Average coefficient of thermal expansion;
- c) Chemical composition of glass; and
- d) Tensile and bending strength at ambient and maximum operating temperature.

5 DIMENSIONS

5.1 The lengths, widths and thicknesses of through-vision and reflex glasses shall be as specified in Table 1.

5.2 Gauges incorporating reflex glasses to these dimensions and tolerances shall not be used for steaming applications at gauge pressures above 2 500 kPa. Gauges incorporating through-vision glasses can be used for steaming applications at gauge pressures up to 2 500 kPa without mica protection of the face and up to 8 000 kPa with mica protection of the face.

5.3 Glasses for use on steam boilers operating at pressures higher than those specified in 4.2 shall be to dimensions and tolerances as agreed between the purchaser and the manufacturer.

5.4 The thickness of any one glass shall not vary by more than 0.08 mm.

5.5 The ends shall be semi-circular within the tolerances specified in Table 1 for length and width.

6 FLATNESS

All working flat faces of through-vision and reflex glasses shall be plane within the limits specified in Table 2 as determined by the use of an inspection table and feeler gauges or other suitable method.

7 JOINT FACES AND EDGES FOR REFLEX GLASSES

7.1 The minimum width of glass face in contact with the packing shall be 6 mm.

7.2 The grooves shall be formed so as to produce a marked contrast in appearance between the liquid and gaseous phases to be viewed through the glass.

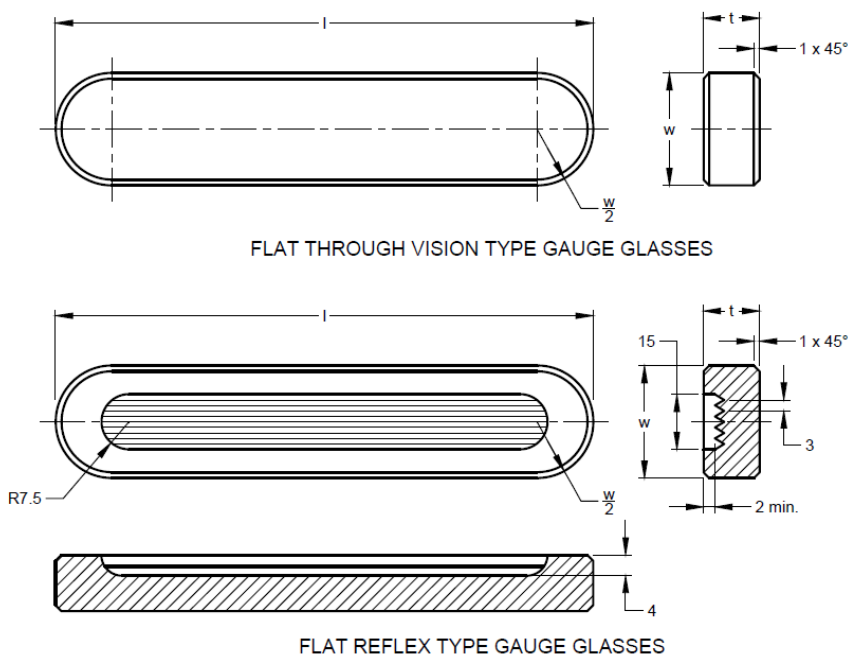
7.3 The thickness of glass between the bottom of each groove and the opposite face shall not be less than 12.5 mm.

7.4 All glasses, including cut and moulded glasses, shall be radiused or arrised to remove sharp corners.

Table 1 Dimensions and Tolerances for Through-Vision and Reflex Glasses

(Clause 5.1 and 5.5)

All dimensions in millimetres.



Sl No.	Size	Length	Width	Thickness
		$l \pm 1$	w $+0.5$ -1.0	t $+0.5$ -1.0
(1)	(2)	(3)	(4)	(5)
i)	0	95	34	17.5
ii)	1	115	34	17.5
iii)	2	140	34	17.5
iv)	3	165	34	17.5
v)	4	190	34	17.5
vi)	5	220	34	17.5
vii)	6	250	34	17.5
viii)	7	280	34	17.5
ix)	8	320	34	17.5
x)	9	340	34	17.5
xi)	10	370	34	17.5

NOTE — Particular design requirements may necessitate manufacturers to closer tolerances, which shall be subject to agreement between the purchaser and the manufacturer.

Table 2 Flatness Limits for Through-Vision and Reflex Glasses

(Clause 6)

Sl No.	Size	0	1	2	3	4	5	6	7	8	9	10
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)
i)	Flatness limit, mm	0.05	0.05	0.05	0.05	0.08	0.08	0.15	0.15	0.25	0.25	0.25

8 TESTS

8.1 Inspection under Polarized Light

Each toughened through-vision or reflex glass shall be examined under polarized light for adequacy of toughening. Any glass which does not show a polarization pattern indicative of toughening shall be rejected. Hoop stress, as seen in the strain viewer shall be of similar intensity at all edges and shall not be interrupted by the incidence of surface cracks. Once the glass passes this test, it shall be subjected to thermal shock test.

8.2 Thermal Shock Requirements

Manufacturer shall certify that toughened through-vision and reflex glasses shall pass the thermal shock test and acceptance conditions described in 8.4 of IS 5428 (Part 1). During the test, toughened glasses shall enter the water with an observation face parallel to the water surface.

8.3 Hydrostatic Test

The assembly shall be hydro tested at a minimum pressure of $1.5 \times \text{operating pressure} \times \text{allowable stress of glass at ambient temperature/allowable stress of glass at operating temperature}$.

9 SAMPLING

Two percent of the glasses (but not less than 10 or more than 30 glasses) shall be taken by random

selection from each consignment. If more than 10 percent but not more than 20 percent of the glasses in the sample fail the test, a further sample of 2 percent shall be taken by random selection from the consignment and subjected to a second test. Glasses subjected to and passing the test may be put into service.

10 MARKING

10.1 The through-vision and reflex glasses shall be permanently marked with the following:

- a) Manufacturer's identification or trade-mark; and
- b) The size of the through-vision and reflex glass.

10.2 BIS Certification Marking.

The product(s) conforming to the requirements of this standard may be certified as per the conformity assessment schemes under the provisions of the *Bureau of Indian Standards Act, 2016* and the Rules and Regulations framed thereunder, and the products may be marked with the Standard Mark.

11 PACKING

The glasses shall be packed securely in suitable inner boxes, containing not more than 24 glasses and adequately cased for transit.

ANNEX A

(Informative)

RECOMMENDATIONS ON GLASSES

A-1 Reflex glasses and through-vision glasses without mica protection, are not recommended for use above 2 500 kPa in steam installations, or above 8 000 kPa for other purposes. For installations at higher pressures, manufacturers' recommendations should be obtained.

A-1.1 Glasses suitable for work at higher temperatures are obtainable; information regarding special applications should be obtained from the manufacturers.

A-1.2 Through-vision and reflex glasses are not recommended for greater maximum working temperature and temperature differentials (ambient to fluid) than those given below. These figures have been adjusted so that they apply to the differential between the ambient and fluid temperatures, because of the impracticability of measuring actual glass surface.

SI No.	Recommended Maximum Working Temperatures and Temperature Differentials		
	Type of Glass	Maximum Working Temperature °C	Maximum Temperature Differential (Ambient to Fluid) °C
(1)	(2)	(3)	(4)
i)	Annealed soda-lime	350	40
ii)	Toughened soda-lime	300	265

SI No.	Recommended Maximum Working Temperatures and Temperature Differentials		
	Type of Glass	Maximum Working Temperature °C	Maximum Temperature Differential (Ambient to Fluid) °C
(1)	(2)	(3)	(4)
iii)	Annealed borosilicate	400	110
iv)	Toughened borosilicate	360	265

A-2 CORROSION

Corrosion of glass on pressure vessels is sometimes a problem requiring consideration, because of the faster rate of chemical reactions at temperatures and pressures above atmospheric. Borosilicate glass is more resistant than soda-lime glass to attack by hot water and acids. Toughening does not increase the corrosion resistance of glass. For use under severe conditions, for instance in the presence of alkalis where the consequences of failure would be serious, the use of two glasses (each capable of withstanding the full pressure) is to be preferred. In boiler practice, the glass is frequently protected by mica, alternatively, corrosion may be minimized by control of the fluid circulation. The glass manufacturer should be consulted regarding the possible effect of corrosion on the properties of glass for pressure vessels wherever particularly adverse conditions are likely to be encountered.

ANNEX B*(Foreword)***COMMITTEE COMPOSITION**

Chemical Engineering Plants and Related Equipment Sectional Committee, MED 17

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CSIR - Indian Institute of Petroleum, Dehradun	DR MRITUNJAY KUMAR. SHUKLA (<i>Chairperson</i>)
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Indian Oil Corporation Limited, New Delhi	SHRI KARAN AGRAWAL
Indian Rubber Manufacturers Research Association, Mumbai	DR K. RAJ KUMAR DR DEBDIPTA BASU (<i>Alternate</i>)
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L&T Valves, Chennai	SHRI ROHIT SHARMA SHRI SURIYANARAYANAN (<i>Alternate</i>)
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MECON Limited, Ranchi	SHRI YOGENDRA KUMAR SINGH SHRI ARVIND BHUSHAN (<i>Alternate</i>)

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<i>Organization</i>	<i>Representative(s)</i>
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Member Secretary
MS NEHA THAKUR
SCIENTIST 'B'/ASSISTANT DIRECTOR
(MECHANICAL ENGINEERING), BIS

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BUREAU OF INDIAN STANDARDS

Headquarters:

Manak Bhavan, 9 Bahadur Shah Zafar Marg, New Delhi 110002

Telephones: 2323 0131, 2323 3375, 2323 9402

Website: www.bis.gov.in

Regional Offices:

	Telephones
Central : 601/A, Konnectus Tower -1, 6 th Floor, DMRC Building, Bhavbhuti Marg, New Delhi 110002	{ 2323 7617
Eastern : 8 th Floor, Plot No 7/7 & 7/8, CP Block, Sector V, Salt Lake, Kolkata, West Bengal 700091	{ 2367 0012 2320 9474
Northern : Plot No. 4-A, Sector 27-B, Madhya Marg, Chandigarh 160019	{ 265 9930
Southern : C.I.T. Campus, IV Cross Road, Taramani, Chennai 600113	{ 2254 1442 2254 1216
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